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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/087,556

03/01/2002

Katsumi Yamaguchi

TI-31471

2191

23494

7590

03/13/2003

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EXAMINER

IM, JUNGHWA M

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 03/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/087,556

Applicant(s)

YAMAGUCHI ET AL.

Examiner

Junghwa M. Im

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 9-22 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 9-22 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Acknowledgement

Applicant's Amendment to Paper 6 has been entered and made of record. Claims 7 and 8 are cancelled, and new claims 9-22 have been added. Therefore, claims 1-6 and 9-22 are pending.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6, 9, 11, 12 and 18-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Murakami (US 5,874,780).

Regarding claims 1 and 3-6, Fig. 7C of Murakami shows a semiconductor device, comprising:

a contact pad 108 on a semiconductor substrate 105, a conductive gold bump 107 (col. 5, line 14) on the contact pad, the bump comprising a coaxially-aligned circular bodies having different cross-sectional dimensions, said bodies at the top of said stack having smaller cross-sectional dimensions.

Regarding claim 2, Fig. 7C of Murakami shows the uppermost body in the stack has a flat peak plane.

Regarding claim 9, Fig. 7C (or 2C) of Murakami shows bodies at the top of said stack

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have a smaller height than lower bodies in said stack.

Regarding claim 11, Fig. 7C of Murakami shows the semiconductor device further comprising a passivation film 109 around said contact pad.

Regarding claim 12, Fig. 7C of Murakami shows the sides of the contact pad is on an insulating film 109 on said semiconductor substrate.

Regarding claim 18, Fig. 7C of Murakami shows a semiconductor device, comprising:

a semiconductor substrate 105, a contact pad 108 on said semiconductor substrate; a first bump (a larger portion of 107) on said contact pad; a smaller second bump on said first bump, said second bump coaxially aligned with said first bump and having a substantially flat peak plane; a printed circuit board 101, wherein said semiconductor substrate is mounted over said printed circuit board such that said contact pad and said first and second bumps are aligned with a conductive film 118 on said printed circuit board.

Limitations for claims 19-22 have been discussed above.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an

international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1, 3-6, 9, 11, 12 and 18-22 are rejected under 35 U.S.C. 102(e) as being anticipated by Kanda et al. (US 6,153,938), hereafter Kanda.

Regarding claims 1 and 3-6, Fig. 1C of Kanda shows a semiconductor device comprising:
a contact pad (col. 6, lines 15-18) on a semiconductor substrate 1, a conductive gold bump 2 (col. 5, line 43) on the contact pad, the bump comprising a coaxially-aligned circular bodies having different cross-sectional dimensions, said bodies at the top of said stack having smaller cross-sectional dimensions.

Regarding claim 9, Fig. 1C of Kanda shows bodies at the top of said stack have a smaller height than lower bodies in said stack.

Regarding claim 11, Fig. 1C of Kanda shows the semiconductor device further comprising a passivation film 9 around said contact pad.

Regarding claim 12, Fig. 1C of Kanda shows the sides of the contact pad is on an insulating film 9 on said semiconductor substrate.

Regarding claim 18, Fig. 1C of Kanda shows a semiconductor device, comprising:

a semiconductor substrate 1, a contact pad (col. 6, lines 15-18) on said semiconductor substrate; a first bump 2 on said contact pad; a smaller second bump on said first bump, said second bump coaxially aligned with said first bump and having a substantially flat peak plane; a printed circuit board 6, wherein said semiconductor substrate is mounted over said printed circuit

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board such that said contact pad and said first and second bumps are aligned with a conductive film 7 on said printed circuit board.

Limitations for claims 19-22 have been discussed above.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 10, 12 and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanda in view of Lin (US 6,426,556).

Regarding claims 10 and 12, Fig. 1C of Kanda shows substantially the entire claimed device except a barrier layer and an insulation layer. However, Fig. 15 of Lin shows a gold bump (35) formed on a contact pad (24) on an insulating film (29) on a substrate (10) with a barrier formation (33, 34) between the contact pad and the bump. See the respective portions of the specification such as col. 3, lines 11-28.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Lin to the device of Kanda in order to form an barrier layer between a contact pad and a bump since a barrier layer between a contact pad and a bump serves to prevent diffusion of solder material into underlying layers. In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to add an insulating layer on a substrate of Kanda's device with Lin's teaching in order to alleviate a noise interference

through the substrate to a conductive pad.

Regarding claim 13, Fig. 1C of shows Kanda a semiconductor device, comprising:

a contact pad (col. 6, lines 15-18) on a semiconductor substrate (1); a first bump (a larger one of 2) having a first cross-sectional dimension; a second bump on and coaxially aligned with said first bump, said second bump having a cross-sectional dimension smaller than said first cross-sectional dimension. However, Fig. 15 of Lin shows a gold bump (35) formation on a contact pad (24) with a barrier layer (33, 34) in between while a contact pad is formed on a dielectric layer (29) on a substrate (10).

Motivations for a barrier layer and an insulating layer have been discussed above.

Regarding claims 14-17, Fig. 1C of Kanda shows the semiconductor device further comprising a passivation film (9) around said contact pad, and two circular gold bumps(col. 5, line 43) while the height of the first bump is greater than the height of the second bump.

Claims 10, 12 and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami in view of Lin.

Regarding claims 10 and 12, Fig. 7C of Murakami shows substantially the entire claimed device except a barrier layer and an insulation layer. However, Fig. 15 of Lin shows a gold bump (35) formed on a contact pad (24) on an insulating film (29) on a substrate (10) with a barrier formation (33, 34) between the contact pad and the bump. See the respective portions of the specification such as col. 3, lines 11-28.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Lin to the device of Murakami in order to form an barrier layer

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between a contact pad and a bump since a barrier layer between a contact pad and a bump serves to prevent diffusion of solder material into underlying layers. In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to add an insulating layer on a substrate of Murakami's device with Lin's teaching in order to alleviate a noise interference through the substrate to a conductive pad.

Regarding claim 13, Fig. 7C of Murakami shows a semiconductor device, comprising: a contact pad (108) on a semiconductor substrate (105); a first bump (a larger one of 107) having a first cross-sectional dimension; a second bump on and coaxially aligned with said first bump, said second bump having a cross-sectional dimension smaller than said first cross-sectional dimension. However, Fig. 15 of Lin shows a gold bump (35) formation on a contact pad (24) with a barrier layer (33, 34) in between while a contact pad is formed on a dielectric layer (29) on a substrate (10).

Motivations for a barrier layer and an insulating layer have been discussed above.

Regarding claims 14-17, Fig. 1C of Murakami shows the semiconductor device further comprising a passivation film (109) around said contact pad (108), and two circular gold bumps(col. 5, line 14) while the height of the first bump is greater than the height of the second bump.

Response to Arguments

Applicant's arguments with respect to claims 1-6 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (703) 305-3998. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

jmi
March 7, 2003


Sara Crane
Primary Examiner